Targeting Absolute Salinity for Earth and Space

Completed Technology Project (2013 - 2013)

Project Introduction

As part of a grant through a NASA Johnson Space Center (JSC) 2011 Innovation Charge Account (ICA), a novel optical sensor was developed and early feasibility demonstrated in the measurement of concentration factors in spacecraft urine and urine brine waste streams. As part of this development work, a secondary Earth-based application for the sensor was suggested. Specifically, the optical sensor might be used to predict so-called "absolute" salinity, a new salinity parameter believed critical for improved modeling of the ocean's thermodynamic processes and better predicting global climate change. For both applications, the need to improve the sensor's measurement sensitivity was recognized. The current project investigated methods to improve measurement sensitivity over the 2011 developed ICA optical sensor. Interim results suggest up to at least a 20-fold increase in waveguide response can be achieved using a novel design and construction of a hybrid waveguide sensor. The continued development of an optical sensor platform capable of enhanced measurements of solution concentration is certain to find use in a broad range of important Earth and space applications.

As part of a 2011 JSC Innovation Charge Account (ICA) call, a novel in-line optical sensor was developed and early feasibility demonstrated in the measurement of concentration factors in spacecraft urine/urine brine samples using a novel optical waveguide sensor. During the course of the 2011 work, a second application of the waveguide sensor was realized. Specifically, it was conceived that the optical sensor could be packaged and used for in-situ estimates of so-called "absolute" salinity. This salinity parameter is being suggested as a potential new standard for modeling the ocean's thermodynamic processes and better predicting global climate change. For both applications, it was recognized that the sensitivity of the 2011 ICA sensor would need to be improved. The current project proposed the investigation of methods to improve the sensitivity of the optical sensor, by way of parameters such as: the physical dimensions of the system, use of alternative waveguide materials, light sources and light conditioning, and treatments to fiber optic waveguide materials. Interim results have demonstrated at least a 20-fold increase in sensitivity over the concentration range of interest using a novel design and construction of a hybridized waveguide system. A New Technology Report describing the sensor has been submitted, MSC-25706-1.

Anticipated Benefits

Robust sensors capable of measuring concentration factors in spacecraft water recovery systems are needed to maximize recovery yields and improve overall system reliability in current and future space missions.

Optical measurements of "absolute" salinity are being considered as a new standard for thermodynamic modeling of the world's oceans and improving

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

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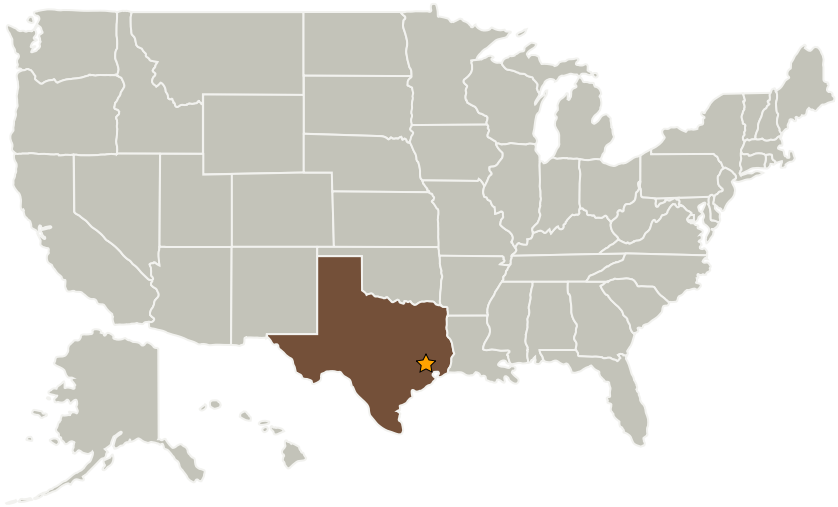
predictions of global climate change. The development of a robust sensor platform capable of providing enhanced salinity measurements is certain to find use in a broad range of important Earth and space applications, e.g., oceanography, climate change studies, space craft and industrial water recovery, environmental science, industrial process control, etc.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations
Texas

Links

NTR 1
(https://invention.nasa.gov/login.php)

Project Management

Program Director:
Michael R Lapointe

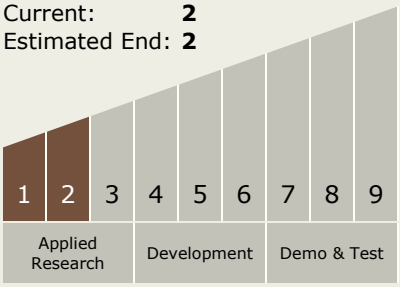
Program Manager:
Carlos H Westhelle

Project Manager:
Michael R Callahan

Principal Investigator:
Michael R Callahan

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors